IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant	:	Simon C. Steely, Jr. et. al.
Serial No.	:	10/758,368
Filing Date	:	January 13, 2004
For	:	SYSTEM AND METHOD FOR UPDATING OWNER PREDICTORS
Group Art Unit	:	2185
Examiner	:	Midys Rojas
Attorney Docket No.	:	200313752-1

Mail Stop Appeal Briefs - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

Pursuant to the Notice of Appeal filed on September 5, 2008, Appellant's representative presents this Appeal Brief.

I. TABLE OF CONTENTS

II. REAL PARTY IN INTEREST

The real party in interest is Hewlett-Packard Development Company, L.P., as indicated by the Assignment recorded on January 15, 2004.

III. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

IV. STATUS OF CLAIMS

Claims 1-8, 10-13, 16-24 and 26-41 which are attached in the first Appendix, are currently pending in this application. Claims 9, 14-15 and 25 have been canceled. Claims 1-8, 10-13, 16-24 and 26-41 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,711,662 to Peir, et al. ("Peir") in view of U.S. Patent Pub. No. 2002/0133674 to Martin, et al. ("Martin").

The rejection of claims 1-8, 10-13, 16-24 and 26-41 is appealed.

V. STATUS OF AMENDMENTS

A response to a Final Office Action ("Final Action") issued on June 16, 2008 was filed on August 5, 2008. After the Final Action, claim 14 was canceled. An Advisory Action Before Filing an Appeal Brief ("Advisory Action") dated August 20, 2008 was issued. The Advisory Action indicated that the request for reconsideration set forth in the Response to the Final Action was considered, but did not place the application in condition for allowance. Additionally, the Advisory Action appeared to provide inconsistent statements regarding the status of the claims. Specifically, the Advisory Action states that the amendments to the claims filed after the Final Action (the cancelation of claim 14) would not be entered for purposes of appeal, but contradicts this statement by indicating that claim 14 is no longer rejected. Thus, Appellant's representative respectfully presumes that the cancellation of claim 14 has been entered, as obviously, a simple cancelation of a claim reduces the issues to be considered on Appeal.

VI. SUMMARY OF THE CLAIMED SUBJECT MATTER

A. Claim 1

One aspect of the invention, as recited in claim 1, is directed to a multi-processor system (200 of FIG. 4; Par. [0057], Page 16, line 21) that comprises an owner predictor control (212 of FIG. 4) that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data (Par. [0066], Page 19, lines 3–6). The update message comprises an address tag associated with the block of data and an identification associated with an owner node of the block of data (Par. [0066], Page 19, line 6). A given one of the plurality of owner predictors (242 of FIG. 4), associated with a processor, comprises a first component (244 of FIG. 4) that predicts an owner node of the block of data by observing the pattern of instructions within the processor and a second component (243 of FIG. 4) that stores ownership update messages provided from the owner predictor control (Par. [0066], Page 19, lines 6–15).

B. Claim 11

Claim 11 is directed to the system (200 of FIG. 4; Par. [0057], Page 16, line 21) of claim 1, wherein the second component (243 of FIG. 4) is operative to prioritize update messages according to a determination at the first component (Par. [0066], Page 19, lines 10–13).

C. Claim 12

Claim 12 is directed to the system (200 of FIG. 4; Par. [0057], Page 16, line 21) of claim 1, wherein the processor employs the given owner predictor to determine a predicted owner for a given block of data (Par. [0068], Page 19, lines 29–32). The given owner predictor selects between accessing the first component and the second component according to the frequency in which ownership update messages associated with the block of data have been received from the owner predictor control (Par. [0068], Page 19, lines 33–34).

D. Claim 13

Another aspect of the invention, as recited in claim 13, is directed to a multi-processor network (50 of FIG. 2; Par. [0026], Page 6, lines 11–13) that comprises a first processor that includes a cache having a plurality of cache lines associated with respective blocks of data (Par. [0028], Page 6, lines 26–29), wherein one cache line in the cache of the first processor transitions to an ownership state based on a response to a request provided by the first processor (Par. [0029], Page 7, lines 6–8). The multi-processor network (50 of FIG. 2; Par. [0026], Page 6, lines 11–13) further comprises a second processor that includes an associated owner predictor (Par. [0029], Page 6, lines 32–33). The multi-processor network (50 of FIG. 2; Par. [0026], Page 6, lines 11–13) still further comprises an owner predictor control (86 of FIG. 2) that broadcasts an update message to respective owner predictors associated with each of a plurality of processors comprising the multi-processor network, including the owner predictor associated with the second processor, to

identify ownership for the one cache line consistent with the one cache line transitioning to the ownership state (Par. [0029], Page 7, lines 6–8).

E. Claim 21

Yet another aspect of the invention, as recited in claim 21, is directed to a system (50 of FIG. 2; Par. [0026], Page 6, line 11) that comprises a requesting node that provides a first request for a block of data to a home node, wherein the requesting node is operative to provide a second request for the block of data to at least one predicted node substantially in parallel with first request (Par. [0042] and Par. [0043], Page 12, lines 4–5, and Page 12, lines 13–14). The requesting node receives at least one coherent copy of the block of data from at least one of the home node and the at least one predicted node (Par. [0045], Page 12 line 31–Page 13, line 2). The system further comprises an owner predictor (64 of FIG. 2) associated with each of a plurality of processor nodes that form the system (Par. [0029], Page 6, lines 32–33). The owner predictor (64 of FIG. 2) of the requesting node is programmed to identify the at least one predicted node for servicing the first request (Par. [0029], Page 7, lines 3–4). The system still further comprises an update control (86 of FIG. 2) that provides an ownership update message to the owner predictor associated with each of the plurality of processor nodes in response to a detecting a change in an ownership state for the block of data (Par. [0029], Page 7, lines 6–8). The update message comprises an address tag associated with the block of data and a processor identification associated with

an owner node of the block of data (Par. [0036] and Par. [0066], Page 10, line 10 and Page 19, line 6).

F. Claim 26

Claim 26 is directed to the system (50 of FIG. 2; Par. [0026], Page 6, line 11) of claim 23, wherein the at least one predicted node comprises the owner node (Par. [0044], Page 12, lines 21–23). The owner node provides a data response to the requesting node in response to which of the second request and the third request that arrives at the owner node first (Par. [0044], Page 12, lines 21–30).

G. Claim 27

Claim 27 is directed to the system (50 of FIG. 2; Par. [0026], Page 6, line 11) of claim 26, wherein the owner node provides a victim message to the home node and the data response to the requesting node in response to the third request arriving at the owner node prior to the second request (Par. [0037], Page 10, lines 18–24). The home node provides a speculation acknowledgement to the requesting node in response to the victim message from the owner node (Par. [0037], Page 10, lines 24–26).

H. Claim 28

Claim 28 is directed to the system (50 of FIG. 2; Par. [0026], Page 6, line 11) of claim 26, wherein the owner node provides a victim message to the home node in response to the second request arriving at the owner node prior to the third request (Par. [0037], Page 10, lines 18–23). The owner node also provides the data

response to the requesting node in response to the second request from the requesting node (Par. [0037], Page 10, lines 22–24).

I. Claim 30

Still another aspect of the invention, as recited in claim 30, is directed to a multi-processor system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) that comprises a means for identifying (24 of FIG. 1, 64 and 74 of FIG. 2, 161-176 of FIG.3, 242 of FIG. 4) a predicted owner node associated with a block of data, wherein a respective one of the means for identifying (14 of FIG. 1, 64 and 74 of FIG. 2, 161-176 of FIG.3, 242 of FIG. 4) is associated with each of a plurality of nodes in the multi-processor system, including a requesting node (12 of FIG.1, 60, 70 and 95 of FIG. 2, 113-128 of FIG. 3, 202 of FIG. 4, 302 of FIG. 5, 322 of FIG. 6, 354 of FIG. 7; Par. [0022], Page 4, lines 31–33; Par. [0029], Page 6, lines 33–34; Par. [0049], Page 14, lines 3–6; Par. [0066], Page 18, line 33–Page 19, line 2; Par. [0086], Page 30, lines 13–14; Par. [0093], Page 31, line 34–Page 32, line 4). The multi-processor system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) further comprises a means for selectively providing (12 of FIG. 1, 62 and 72 of FIG 2, 141-156 of FIG. 3, 228 of FIG. 4) a first request for the block of data from the requesting node to the predicted owner node (Par. [0022], Page 4, lines 29–31; Par. [0043], Page 12, lines 13–15; Par. [0051], Page 15, lines 31–33; Par. [0081], Page 27, lines 15–17; Par. [0086], Page 30, lines 14–16; Par. [0090], Page 31, lines 11–13; Par. [0094], Page 32, lines 5–7). The multi-processor system (10 of FIG. 1; 50 of FIG. 2; 100 of

FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) still further comprises a means for broadcasting updates (24 of FIG. 1; 86 of FIG. 2, 161-176 of FIG. 3, 212 of FIG. 4, 358 of FIG. 7) to all the means for identifying in response to a change in ownership of the block of data, wherein the means for updating being remote from the means for identifying (Par. [0020], Page 4, lines 12–14; Par. [0029], Page 7, lines 6–8; Par. [0051], Page 14, lines 28–30; Par. [0066], Page 19, lines 4–7; Par. [0087], Page 30, lines 24–25; Par. [0091], Page 31, lines 19–21; Par. [0095], Page 32, lines 18–19).

J. Claim 31

Claim 31 is directed to the system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) of claim 30, wherein the system further comprises a means for providing a second request (12 of FIG. 1, 62 and 72 of FIG 2, 141-156 of FIG. 3, 228 of FIG. 4) for the block of data from the requesting node to a home node (Par. [0022], Page 4, lines 29–31; Par. [0042], Page 12, lines 4–5; Par. [0055], Page 15, lines 31–33; Par. [0081], Page 27, lines 15–17; Par. [0086], Page 30, lines 14–16; Par. [0090], Page 31, lines 11–13; Par. [0094], Page 32, lines 5–7). The second request is provided substantially in parallel with the first request (Par. [0022], Page 4, lines 29–31; Par. [0042], Page 12, lines 3–4; Par. [0055], Page 15, lines 31–33; Par. [0081], Page 27, lines 14–15; Par. [0086], Page 30, 14–16; Par. [0090], Page 31, lines 11–13; Par. [0094], Page 32, lines 5–7). The system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) still further comprises a means for

providing a coherent copy of the block of data to the requesting node in response to at least one of the first request and the second request (Par. [0024] and Par. [0025], Page 5 lines 22–24 and Page 5 line 32–Page 6, line 1; Par. [0042] and Par. [0044]–Par. [0045], Page 12, lines 10–12 and Page 12, line 21–Page 13 line 2; Par. [0055] and Par. [0056], Page 16, lines 7–20; Par. [0082] and Par. [0083], Page 28, lines 6–24; Par. [0087], Page 30, lines 17–19; Par. [0095], Page 32, lines 10–12).

K. Claim 32

Claim 32 is directed to the system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) of claim 31, wherein the system further comprises a means for ascertaining (82 of FIG. 2, 182 of FIG. 3, 214 of FIG. 4) whether the predicted owner node has an exclusive cached copy of the block of data (Par. [0023], Page 5, lines 4–5; Par. [0042], Page 12, lines 5–7; Par. [0072], Page 21, lines 10–11; Par. [0086], Page 30 lines 12–13; Par. [0090], Page 31, lines 12–13). The system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) still further comprises a means for providing a third request (18 of FIG. 1, 80 of FIG. 2, 180 of FIG. 3, 210 of FIG. 4, 308 of FIG. 5, 326 of FIG. 6, 358 of FIG. 7) for the block of data from the home node to an owner node when the predicted owner node has the exclusive cached copy of the block of data (Par. [0023], Page 5, lines 16–18; Par. [0042], Page 12, lines 8–9; Par. [0072], Page 21, lines 13–15; Par. [0088], Page 30, lines 29–30).

L. Claim 33

Claim 33 is directed to the system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) of claim 30, wherein the means for updating (24 of FIG. 1; 86 of FIG. 2, 161-176 of FIG. 3, 212 of FIG. 4, 358 of FIG. 7) comprises means for determining a frequency with which the block of data has changed ownership over a period of time (Par. [0052], Page 15, lines 9–10). The means for updating (24 of FIG. 1; 86 of FIG. 2, 161-176 of FIG. 3, 212 of FIG. 4, 358 of FIG. 7) is operative to update the means for identifying for the block of data based on the determined frequency relative to a threshold frequency (Par. [0052], Page 15, lines 10–11).

M. Claim 34

Still yet another aspect of the invention, as recited in claim 34, is directed to a method that comprises updating ownership state information for a block of data at each of a plurality of owner predictors associated with respective processors that form a multi-processor system based at least in part on a change in the ownership state information of the block of data (402 of FIG. 8; Par. [0098], Page 33, lines 3–6). The method further comprises identifying at least one of the processors as a predicted owner node based on the updated ownership state information in a given one of the plurality of owner predictors associated with a respective processor (404 of FIG. 8; Par. [0098], Page 33, lines 6–8).

N. Claim 39

Claim 39 is directed to the system of claim 1, wherein the owner predictor control is configured to discontinue providing the ownership update message corresponding to a given block of data (Par. [0052], Page 15, lines 5–6) based on at least one of (i) an available bandwidth in the system (Par. [0052], Page 15, lines 7–9), or (ii) a frequency with which the given block of data changes ownership (Par. [0052], Page 15, lines 9–11).

O. Claim 41

Claim 41 is directed to the system of claim 13, wherein the owner predictor control is configured to discontinue broadcasting the update message corresponding to a given cache line (Par. [0052] and Par. [0053], Page 15, lines 5–6 and lines 14–16) based on at least one of (i) an available bandwidth in the system (Par. [0052], Page 15, lines 7–9), or (ii) a frequency with which the given block of data changes ownership (Par. [0052], Page 15, lines 9–11).

VII. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Whether claims 1-8, 10-13, 16-24 and 26-41 are made obvious under 35 U.S.C. §103(a) by Peir taken in view of Martin.

VIII. ARGUMENT

A. 35 U.S.C. §103(a) rejection of claims 1-8, 10-14, 16-24 and 26-41 as being made obvious by Peir taken in view of Martin

The following objective inquiry is to control the analysis under 35 U.S.C. 103: "Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented." *KSR v. Teleflex*, 550 U.S. ___, 127 S. Ct. 1727 (U.S. 2007), citing *Graham v. John Deere Co. of Kansas City*, 383 U. S. 1 at 17–18 (U.S. 1966).

1. Claim 1

The Final Action contends that the combination of Peir in view of Martin renders claim 1 obvious. Specifically, the Final Action contends that Peir's disclosure of "prediction based on ownership history" corresponds to a first component of a given owner predictor that predicts an owner node of a block of data by observing the pattern of instructions with a processor, as recited in claim 1 (See Final Action, Page 5, lines 5-8 citing Peir, Col. 3, lines 3-11). Appellant's representative respectfully disagrees.

Significantly, claim 1 recites that a given owner predictor associated with a processor includes two components for predicting an owner node; namely a first

component and a second component. The first component of the given owner predictor predicts an owner node of a block of data by observing a pattern of instructions within the processor with which the given owner predictor is associated. The second component stores ownership update messages provided from an owner predictor control. The Final Action contends that both of the components recited in claim 1 are taught by Peir. In particular, the Final Action alleges that "prediction based on ownership history of the data block" corresponds to the claimed first component that predicts an owner node of the block of data by observing the pattern of instructions within the processor (Final Action, Page 5). Moreover, in the Advisory Action it is stated, "[o]wnership history of a data block is made by observing the system's processors [e.g., more than one processor], thus it is related to processor instructions," (Advisory Action, Page 2, Paragraph 3). However, in contrast to claim 1, Peir does not teach or suggest that any prediction based on the ownership history of a given data block is made by a component of an owner predictor observing the pattern of instructions in its associated processor. In claim 1, the given owner predictor is associated with a processor (e.g., a particular processor). Thus, the first component of the owner predictor of claim 1 predicts an owner node for the block of data by observing the pattern of instructions within its particular processor with which the first component is associated. In contrast, in Peir, the ownership history relates to ownership of the data block and is not associated with a pattern of instructions with any particular processor.

Furthermore, in claim 1, the same owner predictor (which is associated with the same processor) also includes a second component that stores ownership

update messages provided from the owner predictor control. In contrast, Pier discloses a prediction table stored in a home directory 20 or in a prediction facility 22 of a memory 16 (See Peir, FIG. 2 and Col. 2, lines 60-62). Peir explicitly discloses that the prediction facility 22 is the structure that informs a predicted next requestor about a current owner of a data block by sending current owner information to the predicted next requestor (See Peir, Col. 3, lines 40-49). In the Advisory Action, it is stated that "the sending of the current owner current owner information is an ownership update message since it identifies the next predictor requestor (See Advisory Action, Page 2, Paragraph 4). However, the Advisory Action appears to ignore the entire element recited in claim 1. That is, since the prediction table is used by the prediction facility 22 to send the current owner information to a predicted next requestor, such a prediction table does not store any type of ownership update message **provided from an owner predictor control**, in contrast to the second component of the owner predictor recited in claim 1 (emphasis added).

In claim 1, the owner predictor control predicts ownership and provides the ownership update message to at least one owner predictor. Thus, in claim 1, the determination of ownership is distributed between the owner predictor control and the given owner predictor. Additionally, the given owner predictor predicts an owner node based on instructions within the processor as well as stores the ownership update message. Such a combination of prediction mechanisms (*e.g.*, instruction pattern-based prediction of the first component and the ownership state based prediction of the second component based on the update messages), as recited in claim 1, is not taught or suggested by Peir taken in view of Martin.

Additionally, the particular type of prediction described in the cited section of Peir is related to predicting a next requestor of a block of data (See Peir, Col. 3, lines 3-11). The prediction of the next requestor is further described as a mechanism to determine who will be the next requestor so that the prediction facility can send current owner information to the predicted next requestor (See Peir, Col. 3, lines 40-54). Peir taken in view of Martin fails to teach or suggest any structure or process that predicts an owner node of a block of data, in contrast to the first component recited in claim 1.

The Final Action contends that "in predicting the next requestor, the system is predicting the next owner since the next owner is simply the processor to possess the most recently updated copy of the data" (Final Action, Page 2, citing Peir, Col. 2, lines 1-4). Appellant's representative submits that this statement is not supported by Peir and appears illogical or otherwise mischaracterizes what is being described in Peir. Whether the prediction of a next requestor as taught by Peir may, in certain circumstances, result in identifying a next owner is not dispositive regarding the patentability of claim 1.

In the Advisory Action, the rejection of claim 1 is maintained because "[i]n predicting the next requestor, the system is predicting the next owner since the next owner is simply the processor to possess the most recently updated copy of data ([Peir] Col. 2, lines 1-4), therefore, in obtaining the data from the current owner and being able to write/modify the data, the predicted Requestor can become the predicted owner ([Peir] Col. 2, lines 53-59), as discussed in claim 1 of the present application," (Advisory Action, Page 2, Second Paragraph). Appellant's

representative respectfully submits that the permissive language used in the Advisory Action illustrates that Peir has been mischaracterized.

As a specific example, the Advisory Action states "[t]he predicted Requestor **can** become the predicted owner..." (emphasis added). That is, it appears the Advisory Action is admitting that the predicted Requestor is not necessarily the predicted owner. As is known, a request for data made by a processor does not indicate that the requesting processor will become an owner of the data. For instance, it is often the case that priorities can be associated with processors, such that a high priority processor issuing a request for the data will become the next owner of the data, and/or a previously issued request (e.g., a next requestor) for the data will be delayed and/or denied.

The addition of Martin does not make up for the deficiencies of Peir explained above since Martin fails to teach or suggest the owner predictor control and the components of the owner predictor recited in claim 1. Martin discloses a predictor 98 that is employed to predict which processors are likely to have copies of a block 19 being sought (See Peir, Par. [0071]). There is no teaching or suggestion in Martin that the predictor 98 could be used with the prediction facility 22 of Peir. The Final Action alleges that "doing so would provide for an [sic] unit to properly coordinate functions of the predictor and also control communications between the predictor and the other components of the invention" (See Final Action, Pages 5-6). The motivation provided by the Final Action, however, ignores that the coordination between the prediction facility 22 and the current-owner table at each node already exists in the system of Peir, thereby obviating the solely proffered motivation to

combine Peir with Martin. Accordingly, the rationale relied upon to combine Martin with Peir is improper.

Since Peir taken in view of Martin fails to teach or suggest the owner predictor recited in claim 1, and the Final Rejection fails to provide any other evidence sufficient to support a *prima facie* case of obviousness with respect to claim 1, Appellant's representative respectfully submits that claim 1 is patentable. Therefore, Appellant's representative respectfully requests that the rejection of claim 1 be withdrawn.

2. Claims 2-8, 10 and 40

Claims 2-8, 10 and 40 depend from claim 1 and are patentable for at least the same reasons as claim 1, and for the specific elements recited therein. Accordingly, withdrawal of the rejection of claims 2-8, 10 and 40 is respectfully requested.

3. Claim 11

Claim 11 depends from claim 1. In rejecting claim 11, the Final Action alleges that prioritizing, as recited in claim 11, is disclosed in Peir at Col. 2, lines 3-11 (See Final Action, Page 8). However, nothing in the cited section of Peir or Peir, more generally, teaches or suggests any structure or process utilized to prioritize an update message, in contrast to what claim 11 recites relative to the second component. The update message recited in claim 11 (by virtue of claim 11's dependence from claim 1) is provided in response to a change in ownership state of the block of data. Peir discloses a prediction table that appears only to be used in

predicting a next requestor (See e.g., Peir, Col. 3, lines 3-5). In contrast to the owner predictor recited in claim 11, Peir provides no teaching or suggestion of any structure or process that predicts ownership and a component that is operative to prioritize update messages according to a determination at the component that predicts ownership by observing a pattern of instructions within the processor.

Moreover, the Final Action argues, "the [ownership] history is being used to prioritize the update messages since the next owner or requestor identified is identified based on history" (Final Action, Page 3). However, the section of Peir cited to support this argument (Col. 3, lines 3-25) specifically relates to the prediction facility 22, which makes a prediction for current owner information, and sends the current owner information to a predicted requestor (See Peir, Col. 3, lines 40-47). Conversely, in claim 11 (by virtue of claim 11's dependence from claim 1) the recited second component of the owner predictor stores the ownership update messages and, as recited in claim 11, the second component prioritizes the update messages based on a determination by the first component of the owner predictor. Since the first component is not taught or suggested by Peir taken in view of Martin (as discussed with respect to claim 1), there can be no teaching or suggestion in Peir taken in view of Martin about the interrelationship between the first and second components of the given owner predictor which the second component uses to prioritize the update messages received from the owner predictor control. Accordingly, Peir taken in view of Martin fails to teach or suggest the subject matter of claim 11. Moreover, since Peir taken in view of Martin fails to teach or suggest the subject matter of claim 11, and the Final Action fails to provide any other evidence or

rational underpinning sufficient to establish a *prima facie* case of obviousness, claim 11 is not obvious. Withdrawal of this rejection is respectfully requested.

4. Claim 12

Claim 12 depends from claim 1. By virtue of claim 12's dependence from claim 1, the owner predictor recited in claim 12 includes two components as well as a particular use of the first and second components; namely, that a processor employs a given owner predictor to determine a predicted owner and the owner predictor selects between accessing the first component and the second component according to the frequency that update messages have been received from the owner predictor control. In contrast, Peir fails to teach or suggest any selection between components because, as discussed with respect to claim 1, no such first and second components are taught in Peir. Instead, Peir discloses that the processor checks the current owner table for a needed data block and then sends an inquiry to the home directory and to the current owner from the current owner table (See Peir Col. 3, lines 55-67). There is no teaching or suggestion of any selection of between first and second components in Peir taken in view of Martin, particularly not according to the frequency in which the owner predictor receives ownership update messages from the owner predictor control, in contrast to claim 12.

In the Advisory Action, it is stated, "The owner prediction of Peir predicts the next requestor based on the history each time a processor claims new ownership. Therefore, the prediction is done according to the frequency in which a new processor claims new ownership (see Col. 2, lines 60-67)" (Advisory Action, Page 2,

Paragraph 6). Thus, it appears that the Advisory Action's reasoning is based on the erroneous premise that the next requestor disclosed in Peir corresponds to the predicted owner node recited in claim 1 (from which claim 12 depends). Again, the prediction facility 22 in Peir is used to predict not an owner, but to predict a next requestor of a data block whenever a new owner is identified. Moreover, as explained above, claim 12 does not merely recite prediction is done according to a frequency (as is being suggested in the Final Action), but instead selects between two different components of the given owner predictor according to the frequency that ownership update messages are received for the block of data. Thus, the reasoning provided in the Advisory Action for the rejection of claim 12 is erroneous since it fails to consider what is expressly recited in claim 12.

For these reasons, Peir taken in view of Martin fails to teach or suggest the subject matter recited in claim 12. Moreover, since the Final Action fails to provide any other evidence sufficient to establish a *prima facie* case of obviousness with respect to claim 12, claim 12 is patentable. Accordingly, withdrawal of this rejection is respectfully requested.

5. Claim 13

The Final Action contends that claim 13 is made obvious by Peir taken in view of Martin. Appellant's representative respectfully disagrees. Claim 13 recites that an owner predictor control broadcasts an update message to respective owner predictors associated with each of a plurality of processors comprising the multi-processor network. In contrast, a primary object in Peir relates to use of a prediction

facility 22 to provide current owner information to a predicted next requestor (See e.g., Peir Col. 2, lines 60-67). Peir discloses that a data block can be accessed by a single writer and multiple readers (See Peir, Col. 3, lines 33-34). Peir discloses that in such a scenario, the next requestor can be extended to include a small set of processors, namely the multiple readers (See Peir, Col. 3, lines 34-37). Thus, in Peir, it is clear that the next requestor can be extended to a small set (e.g., less than all) of processors.

The U.S. Court of Appeals for the Federal Circuit ("Federal Circuit") has held that if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed Cir. 1984). In Peir, if all processors would receive the current owner information, as is being suggested in the Final Action, at pages 9-10, then there would be no purpose or need for the prediction facility 22 in the system 10. That is, regardless of the size of the multi-processor network, if the prediction facility provided the current owner information to each of the processors as is being suggested in the Final Action, then there would be no reason to predict which processor will be the next requestor. Such a contention (that the prediction facility be disregarded), however, runs directly contrary to Peir's teaching as a whole. Thus, the suggested modification would render the teachings of Peir unsatisfactory for its intended purpose. *Id.*

In the Advisory Action, it is argued, "Since the requestors are a group of processors even the small set of processors meets the broadcasting limitation

wherein the small set of processors (e.g., not all the processors) corresponds to a plurality of processors comprising the multi-processor network" (Advisory Action, Page 2, Paragraph 7). Appellant's representative respectfully disagrees.

The unambiguous language of claim 13 recites that an owner predictor control broadcasts an update message to respective owner predictors associated with each (e.g., all) of a plurality of processors comprising the multi-processor network. Additionally, such plurality of processors of the multiprocessor network would also implicitly include the first processor. Consequently, there is no teaching or suggestion in Peir to broadcast an update message to respective owner predictors for each of the plurality of processors, as recited in amended claim 13. Instead, the prediction facility 22 of Peir is disclosed as a part necessary for operation of the system 10 so that the requestor or a small set of requestors can receive the current owner information. Accordingly, Peir taken in view of Martin does not teach or suggest the owner predictor recited in claim 13. Therefore, Peir taken in view of Martin does not teach or suggest the subject matter of claim 13. Moreover, since the Final Action fails to provide any other evidence sufficient to establish a *prima facie* case of obviousness with respect to claim 13, Appellant's representative respectfully submits that claim 13 is patentable. Accordingly, withdrawal of this rejection is respectfully requested.

6. Claims 16-20

Claims 16-20 depend from claim 13 and are patentable for at least the same reasons as claim 13, and for the specific elements recited therein. Accordingly, withdrawal of the rejection of claims 16-20 is respectfully requested.

7. Claim 21

Claim 21 is patentable for similar reasons to those discussed with respect to claim 13. However, claim 21 uses slightly different language by reciting that an owner predictor is associated with each of a plurality of processor nodes that form the system and an update control provides an ownership update message to the owner predictor associated with each of the plurality of processor nodes. That is, the processor nodes are recited as forming the system and the ownership update message is provided to the owner predictor associated with each of the plurality of processor nodes. Accordingly, claim 21 is patentable, and withdrawal of this rejection is respectfully requested.

8. Claims 22-24 and 26

Claims 22-24 and 26 depend from claim 22 and are patentable for at least the same reasons as claim 22, and for the specific elements recited therein. Accordingly, withdrawal of the rejection of claims 22-24 and 26 is respectfully requested.

9. Claim 27

Claim 27 depends from claim 21. In rejecting claim 27, the Final Action relies on a teaching in Peir at Col. 4, lines 51-67 (See Final Action, Page 13). The cited section of Peir specifically states that "[i]f processor C is indeed the actual current owner (step 38), the home directory 20 will not respond to the inquiry; otherwise, the prediction facility 22 updates the prediction table to reflect the ownership of data X (step 40)" (Peir, Col. 4, lines 61-64). Thus, Peir explicitly discloses that the home directory 20 does not respond if the predicted owner C is actually the owner. In contrast, claim 27 recites that the home node provides a speculation acknowledgement to the requesting node in response to the victim message from the owner. Peir further fails to teach or suggest that the owner provides a victim message to the home node, as recited in claim 27. Instead, Peir discloses that the home directory 20 checks if processor C is the actual current owner (Pier, Col. 4, lines 59-61) and does not send any victim message to the home node in response to the third request (from the home node) arriving at the owner node before the second request (from the requesting node). This is in contrast to the expressly recited functionality of the owner node in claim 27. Claim 27 thus recites a particular timing relationship between the requests and the victim message that is not taught or suggested in the cited section of Peir, or Peir, more generally.

The Final Action seems to misunderstand the relationship between requests and messages that are recited in claim 27. In claim 27, the requestor sends multiple requests, the first request to the home node and a second request to the predicted owner (from claim 21, from which claim 27 depends). Peir discloses an inquiry to the

home directory 22 (**not** a request) and the that the home directory 20 will not respond to the inquiry if the predicted current owner is the current owner (See Peir, Col. 4, line 51, through Col. 5, line 6). Significantly, Peir distinguishes a request from an inquiry (the inquiry is to confirm whether the current owner is correct) (See Peir, Col. 4, lines 3-5). Moreover, Peir explicitly discloses that the home directory 20 will not respond to this inquiry regardless of whether the predicted current owner is the actual owner (see Peir, 39 and 43 of FIG. 3B). Moreover, the section of Peir at Col. 5, lines 1-6, relates specifically to a situation when a requesting processor P does not find the current owner in its current owner table.

Claim 26 from which claim 27 depends recites that the predicted node comprises the owner node, such that the description at Col. 5 lines 1-6 is not relevant (since it relates to when Processor P does not find a current owner). Significantly, in Col. 5, lines 1-6, of Peir no parallel request and inquiry are sent out to the home directory 22, but instead only a single request for the data is sent to the home node, which sends a request to the current owner, which results in the owner returning the data X to the processor P and to the home directory 22. To bolster this argument, the Advisory Action states, "the owner node sends the data X not only to the requestor, but also to the home node; thus qualifying as the victim message (See Col. 5, lines 1-6)" (Advisory action, Page 2, Paragraph 9). However, in no scenario described in Peir is there any victim message provided to the home node, which results in a corresponding speculation acknowledgement being provided to the requesting processor P, consistent with what is recited in claim 27. Accordingly, Peir taken in view of Martin does not teach or suggest the subject matter recited in

claim 27. Moreover, since the Final Action fails to provide any other evidence or rational underpinning sufficient to establish a *prima facie* case of obviousness with respect to claim 27, claim 27 is patentable. Thus, withdrawal of this rejection is respectfully requested.

10. Claim 28

Claim 28 depends from claim 26. Claim 28 is patentable for similar reasons as claim 27, in that claim 28 recites an owner node provides a data response to a requesting node in response to a second request from the requesting node. The Final Action relies on the same section of Peir as was used to reject claim 27, namely the description relative to FIG. 3B and in particular Col. 5 lines 1-6 (See Final Action, Pages 13 and 14). As discussed above with respect to claim 27, however, this section of Peir (at Col. 5, lines 1-6), relates specifically to a situation when the requesting processor P does not find the current owner in the current owner table, whereas claim 28, by virtue of its dependency from claim 26, recites that the predicted node comprises the owner node. Moreover, a victim message as recited in claim 28, does not correspond to a data response which the current owner returns to processor P and to the home directory 20 as in Peir (See Peir, Col. 5 lines 5-6). Accordingly, Peir taken in view of Martin does not teach or suggest the subject matter recited in claim 27. Moreover, since the Final Action fails to provide any other evidence or a rational underpinning sufficient to establish a *prima facie* case of obviousness with respect to claim 27, claim 27 is patentable. Thus, withdrawal of this rejection is respectfully requested.

11. Claim 30

Claim 30 is patentable for substantially the same reasons as discussed above with respect to claim 13 and 21. Claim 30 recites a means for broadcasting updates **to all means for identifying** in response to a change in ownership of the block of data, the means for updating being remote from the means for identifying (emphasis added). The Final Action agrees that the next requestor in Peir may not be ALL the processors (See Final Action, Page 4, second paragraph). Moreover, despite the different claim language between claims 21 and 30, the Final Action simply relies on the same rationale used to reject claim 21 as its sole basis for rejecting claim 30. Claim 30 is patentable for reasons similar to those explained with respect to claim 21. Appellant's position should be strengthened for claim 30 because of the differences between claims 30 and 21 and due to the Final Action's own admission. Thus, withdrawal of this rejection is respectfully requested.

12. Claims 31-33

Claims 31-33 depend from claim 30 and are patentable for at least the same reasons as claims 31-33, and for the specific elements recited therein. Accordingly, withdrawal of the rejection of claims 31-33 is respectfully requested.

13. Claim 34

Claim 34 is not made obvious by Peir taken in view of Martin for similar reasons to those discussed with respect to claims 13 and 30 since claim 34 recites

that the update ownership state information is updated at each of a plurality of owner predictors associated with processors that form a multi-processor system. Accordingly, withdrawal of this rejection is respectfully requested.

14. Claims 35-38

Claims 35-38 depend from claim 34 and are patentable for at least the same reasons as claim 34, and for the specific elements recited therein. Accordingly, withdrawal of the rejection of claims 35-38 is respectfully requested.

15. Claim 39-41

Claims 39 and 41 depend from claims 1 and 13. In rejecting claims 39 and 41, the Final Action does not appear to have considered what is expressly recited in these claims. The Final Action states that Peir predicts the next requestor based on history each time a processor claims new ownership and, therefore, prediction is done according to frequency (See Final Action, Pages 14-15). However, each of claims 39 and 41 do not recite that prediction is performed according to a frequency at which a new processor claims ownership (as stated in the Final Action). Instead, claims 39 and 41 recite that the owner predictor control is configured to discontinue broadcasting the update message based on one or more of (i) an available bandwidth in the system, or (ii) a frequency with which the given block of data changes ownership. In view of the substantial differences between claims 39 and 41 and the teachings of Peir, the Final Action has failed to present any evidence sufficient to support the legal conclusion that claims 39 and 41 are obvious.

Moreover, the Advisory Action states, "[t]he update message being broadcasted based on the conditions is part of the prediction process. Therefore, in predicting based on the conditions, as claimed, the system is broadcasting the information necessary based on the same conditions," (Advisory Action, Page 11). Appellant's representative respectfully submits that these arguments offered in the Advisory Action are irrelevant, since the Advisory Action fails to even allege that Peir taken in view of Martin teaches or suggests discontinuing broadcasting, as recited in claims 39 and 41. Thus, no *prima facie* case of obviousness has been established for claims 39 and 41. Accordingly, claims 39 and 41 are patentable, and withdrawal of this rejection is respectfully requested.

IX. APPENDICES

The first attached Appendix contains a copy of the claims on appeal.

The second and third Appendices have been included to comply with statutory requirements.

No additional fees should be due for this Brief. In the event any fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to Deposit Account No. 08-2025.

Respectfully submitted,

/Gary J Pitzer/

Gary J. Pitzer
Registration No. 39,334
Attorney for Applicant(s)

I hereby certify that this correspondence is being transmitted to the U.S. Patent and Trademark Office via electronic filing on October 29, 2008.

CUSTOMER NO.: 022879

Hewlett-Packard Company
Legal Department MS 79
3404 E. Harmony Road
Ft. Collins, CO 80528

Claims Appendix

1. (Finally Rejected) A multi-processor system comprising:

an owner predictor control that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data, the update message comprising an address tag associated with the block of data and an identification associated with an owner node of the block of data; and

wherein a given one of the plurality of owner predictors, associated with a processor, comprises a first component that predicts an owner node of the block of data by observing the pattern of instructions within the processor and a second component that stores ownership update messages provided from the owner predictor control.

2. (Finally Rejected) The system of claim 1, wherein the owner predictor control provides an ownership update message when the block of data at the owner node transitions to one of a modified or exclusive state.

3. (Finally Rejected) The system of claim 1, further comprising a requesting node that provides a first request for the block of data to a home node, the requesting node being operative to provide a second request for the block of data to at least one predicted node in parallel with first request, the at least one predicted node being selected by an associated one of the plurality of owner predictors.

4. (Finally Rejected) The system of claim 3, wherein the requesting node receives a coherent copy of the block of data from at least one of the home node and the at least one predicted node, the requesting node consuming a first coherent copy of the block of data received.

5. (Finally Rejected) The system of claim 3, wherein a cached copy of the block of data exists at the owner node, the home node issuing a third request for the block of data to the owner node.

6. (Finally Rejected) The system of claim 5, wherein the system employs a directory-based cache coherency protocol, the home node further comprising a directory that maintains directory state information associated with the block of data, the home node issuing the third request to the owner node based on the directory state information indicating that the owner node has an exclusive cached copy of the block of data.

7. (Finally Rejected) The system of claim 5, wherein the owner node provides one of (i) a response to the home node and (ii) a response to the home node and to the requesting node, the owner node providing the response based on a state of the cached copy of the block of data at the owner node.

8. (Finally Rejected) The system of claim 5, wherein the at least one predicted node comprises the owner node, the owner node having an exclusive cached copy of the block of data and providing a data response to the requesting node based on which of the second request and the third request arrives at the owner node first.

9. (Cancelled)

10. (Finally Rejected) The system of claim 1, wherein the second component stores the provided update messages according to a first-in-first-out (FIFO) arrangement.

11. (Finally Rejected) The system of claim 1, wherein the second component is operative to prioritize update messages according to a determination at the first component.

12. (Finally Rejected) The system of claim 1, wherein the processor employs the given owner predictor to determine a predicted owner for a given block of data, the given owner predictor selecting between accessing the first component and the second component according to the frequency in which ownership update messages associated with the block of data have been received from the owner predictor control.

13. (Finally Rejected) A multi-processor network comprising:

a first processor that includes a cache having a plurality of cache lines associated with respective blocks of data, one cache line in the cache of the first processor transitioning to an ownership state based on a response to a request provided by the first processor;

a second processor that includes an associated owner predictor;

an owner predictor control that broadcasts an update message to respective owner predictors associated with each of a plurality of processors comprising the multi-processor network, including the owner predictor associated with the second processor, to identify ownership for the one cache line consistent with the one cache line transitioning to the ownership state.

14-15. (Cancelled)

16. (Finally Rejected) The network of claim 13, wherein the owner predictor control monitors available bandwidth in the network and provides the update message based on the available bandwidth relative to a threshold value.

17. (Finally Rejected) The network of claim 13, the network further comprising a home node having a directory that includes directory state information associated with the plurality of cache lines, the directory state information being updated to reflect the one cache line transitioning to the ownership state, and the owner predictor control providing an update message in response to the updating of the directory state information.

18. (Finally Rejected) The network of claim 17, wherein the second processor provides a first request for data to the home node and a second request for the data at least one predicted node identified by the owner predictor.

19. (Finally Rejected) The network of claim 18, wherein the at least one predicted node comprises the first processor based on the update message.

20. (Finally Rejected) The network of claim 17, further comprising an unordered network interconnect that enables communication of requests, responses, and update messages among at least the first processor, the second processor and the home node.

21. (Finally Rejected) A system comprising:

a requesting node that provides a first request for a block of data to a home node, the requesting node being operative to provide a second request for the block of data to at least one predicted node substantially in parallel with first request, the requesting node receiving at least one coherent copy of the block of data from at least one of the home node and the at least one predicted node;

an owner predictor associated with each of a plurality of processor nodes that form the system, the owner predictor of the requesting node programmed to identify the at least one predicted node for servicing the first request; and

an update control that provides an ownership update message to the owner predictor associated with each of the plurality of processor nodes in response to a detecting a change in an ownership state for the block of data, the update message comprising an address tag associated with the block of data and a processor identification associated with an owner node of the block of data.

22. (Finally Rejected) The system of claim 21, wherein the at least one coherent copy of the block of data is returned to the requesting node as a response in a response channel, the response being provided by the at least one predicted node.

23. (Finally Rejected) The system of claim 21, wherein the home node provides a third request for the data to an owner node if the owner node has an exclusive cached copy of the requested data.

24. (Finally Rejected) The system of claim 23, wherein the first request is provided in a request channel, and the second and third requests are each provided in a forward channel.

25. (Cancelled)

26. (Finally Rejected) The system of claim 23, wherein the at least one predicted node comprises the owner node, the owner node providing a data response to the requesting node in response to which of the second request and the third request that arrives at the owner node first.

27. (Finally Rejected) The system of claim 26, wherein the owner node provides a victim message to the home node and the data response to the requesting node in response to the third request arriving at the owner node prior to the second request, the home node providing a speculation acknowledgement to the requesting node in response to the victim message from the owner node.

28. (Finally Rejected) The system of claim 26, wherein the owner node provides a victim message to the home node in response to the second request arriving at the owner node prior to the third request, the owner node also providing the data response to the requesting node in response to the second request from the requesting node.

29. (Finally Rejected) The system of claim 21, wherein the at least one predicted node further comprises a target node having a cache that includes the data having one of an invalid state and a shared state, the at least one predicted node providing a miss response to the requesting node in response to the second request, and the owner node providing a data response to the requesting node in response to the third request.

30. (Finally Rejected) A multi-processor system comprising:

means for identifying a predicted owner node associated with a block of data, a respective one of the means for identifying being associated with each of a plurality of nodes in the multi-processor system, including a requesting node;

means for selectively providing a first request for the block of data from the requesting node to the predicted owner node; and

means for broadcasting updates to all the means for identifying in response to a change in ownership of the block of data, the means for updating being remote from the means for identifying.

31. (Finally Rejected) The system of claim 30, further comprising:

means for providing a second request for the block of data from the requesting node to a home node, the second request being provided substantially in parallel with the first request; and

means for providing a coherent copy of the block of data to the requesting node in response to at least one of the first request and the second request.

32. (Finally Rejected) The system of claim 31, further comprising:

means for ascertaining whether the predicted owner node has an exclusive cached copy of the block of data; and

means for providing a third request for the block of data from the home node to an owner node when the predicted owner node has the exclusive cached copy of the block of data.

33. (Finally Rejected) The system of claim 30, wherein the means for updating comprises means for determining a frequency with which the block of data has changed ownership over a period of time, the means for updating being operative to update the means for identifying for a the block of data based on the determined frequency relative to a threshold frequency.

34. (Finally Rejected) A method comprising:

updating ownership state information for a block of data at each of a plurality of owner predictors associated with respective processors that form a multi-processor system based at least in part on a change in the ownership state information of the block of data; and

identifying at least one of the processors as a predicted owner node based on the updated ownership state information in an given one of the plurality of owner predictors associated with a respective processors.

35. (Finally Rejected) The method of claim 34, further comprising:

issuing a first request for the block of data from a requester to a home node;

concurrently issuing a second request for the block of data from the requester to the predicted owner node based on the updated ownership state information; and

receiving at least one coherent copy of the block of data at the requester from an owner processor, if the owner processor has an exclusive cached copy of the block of data, and from the home node, if no exclusive cached copy of the block of data exists when the home node receives the first request.

36. (Finally Rejected) The method of claim 35, further comprising issuing a third request for the block data from the home node to the owner processor in response to determining that the owner processor has the exclusive cached copy of the block of data.

37. (Finally Rejected) The method of claim 36, further comprising providing the at least one coherent copy of the block of data in response to the second request when owner processor receives the second request prior to the third request.

38. (Finally Rejected) The method of claim 36, further comprising providing the coherent copy of the block of data in response to the third request when owner processor receives the third request prior to the second request.

39. (Finally Rejected) The system of claim 1, wherein the owner predictor control is configured to discontinue providing the ownership update message corresponding to a given block of data based on at least one of (i) an available bandwidth in the system, or (ii) a frequency with which the given block of data changes ownership.

40. (Finally Rejected) The system of claim 1, wherein the owner predictor control is programmed to broadcast the ownership update message each of the plurality of owner predictors to indicate the change in the ownership state of the block of data.

41. (Finally Rejected) The system of claim 13, wherein the owner predictor control is configured to discontinue broadcasting the update message corresponding to a given cache line based on at least one of (i) an available bandwidth in the system, or (ii) a frequency with which the given block of data changes ownership.

Evidence Appendix

None

Related Proceedings Appendix

None